Name _____

# Corn Crop Genetics:
# Breeding Corn for Two Traits

## Background

Now you will examine the inheritance of two traits determined by genes found on different chromosomes in corn: the color of the corn kernels (purple vs yellow) and the taste of the kernels (sweet vs starchy). Each corn kernel is an embryo, so the kernels on an ear of corn are essentially a large collection of offspring from a specific genetic cross. Sweet kernels are wrinkled in appearance; starchy kernels are smooth. Purple is dominant over yellow, and starchy is dominant over sweet. The genotype of a homozygous purple and starchy corn plant can be written "PPSS" while the genotype of a homozygous yellow and sweet variety can be written "ppss."

What type of corn will we get if we cross a homozygous purple and starchy plant (PPSS) with a homozygous yellow and sweet one (ppss)? Each plant produces gametes with one allele for each trait. The homozygous purple and starchy plant (PPSS) can only produce gametes with a purple allele for the color trait and a starchy allele for taste (PS). The homozygous yellow and sweet plant (ppss) produces only yellow sweet gametes (ps). But what kinds of corn kernels will result from a cross between two first-generation PpSs plants?

## A. Expected Results

Begin by determining the possible alleles in the gametes from each parent. What combinations can be produced by each PpSs parent? (Remember, each combination should include one of the alleles for color and one of the alleles for taste).

- Fill in the possible allele combinations in the dotted blanks on the Punnett square below.
- Then complete the Punnett square showing the genetic possibilities for the offspring of a cross between two PpSs parents.

Parent 1
PpSs

| Parent 2 PpSs | _ _ _ _ | _ _ _ _ | _ _ _ _ | _ _ _ _ |
|---|---|---|---|---|
| _ _ _ _ | | | | |
| _ _ _ _ | | | | |
| _ _ _ _ | | | | |
| _ _ _ _ | | | | |

B. Actual Results

Corn Ear C is the result of a cross between two first-generation PpSs plants. It is called the second generation of F2.

- Count the number of each of the four kernel types found on Corn Ear C and record your results in the data table below.
- Then determine the phenotypic ratio by dividing the number counted in each column by the total number of yellow, sweet kernels counted (last column).

| | # of purple starchy (smooth) kernels | # of purple sweet (wrinkled) kernels | # of yellow starchy (smooth) kernels | # of yellow sweet (wrinkled) kernels |
|---|---|---|---|---|
| Corn Ear C | | | | |
| Phenotypic Ratio | | | | |

C. Questions

1. According to your Punnett square, how many different ***genotypes*** should be present in the kernels of second-generation Corn Ear C? _____ Now list them below:

2. According to your Punnett square, how many different ***phenotypes*** should be observed in the kernels of Corn Ear C? _____ Now list them below:

3. Use your Punnett square to predict the ratio of the different phenotypes produced by this cross.
   ____ purple starchy; ____ purple sweet; ____ yellow starchy; ____ yellow sweet

4. How closely did the ratio of phenotypes from Corn Ear C in your data table correspond to the ratio predicted by the Punnett square?

5. Would you expect the actual ratio to be the same as the predicted ratio? Why or why not?

6. Imagine you have several corn plants that have produced only purple starchy kernels. You want to determine whether these plants are homozygous for the dominant purple and starchy traits. What could you do to find out if your plants are homozygous?

D. Working Backwards

Imagine that you carried out the procedure discussed in Question 6 and your results are plants with ears like Corn Ear D.

- Count the kernels on Corn Ear D and record your results in the data table below.
- Then determine the phenotypic ratio (round to the nearest whole number)

| | # of purple starchy (smooth) kernels | # of purple sweet (wrinkled) kernels | # of yellow starchy (smooth) kernels | # of yellow sweet (wrinkled) kernels |
|---|---|---|---|---|
| Corn Ear D | | | | |
| Phenotypic Ratio | | | | |

- Is your plant homozygous or heterozygous for the two traits?

Support your answer with a Punnett square and explanation of its phenotypic ratio.